

meeting defense needs affordably...
NOW AND INTO THE FUTURE

1999 annual report



NCEMT 

National Center for Excellence in Metalworking Technology

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l e t t e r s



Richard J. Henry



Steven M. Linder

Since 1988, the National Center for Excellence in Metalworking Technology (NCEMT) has been meeting defense needs affordably. As the focal point for Navy Manufacturing Technology (MANTECH) metalworking activities, the NCEMT is a valuable asset in the cost-effective production and performance of Navy weapons systems components.

As the primary problem-solver for Navy metalworking problems, the NCEMT combines leading-edge capabilities, world-class expertise, and a genuine commitment to excellence. The NCEMT develops, evaluates, and transfers manufacturing technologies to help the Navy and other services reduce life-cycle costs and increase reliability of components. Many of these technologies succeed because of the NCEMT's use of integrated project teams. Assembling the specific expertise and resources needed for each project leads to the very best solution at the very least cost and optimizes the use of materials and energy.

As always, I welcome your questions and comments and would be pleased to provide more information about the NCEMT and the metalworking solutions we can offer your organization now and into the future.

Sincerely,

A handwritten signature in cursive script, reading "Richard J. Henry".

Richard J. Henry
NCEMT Program Manager

The NCEMT has a leading role in supporting the Navy MANTECH mission of developing world-class manufacturing technology solutions for defense weapons systems.

Through changing defense needs and priorities, the NCEMT continues to contribute substantial technology advances and cost avoidance that span the full complement of Navy and Marine Corps ships, aircraft, vehicles, and ordnance. As the focal point for advanced metalworking solutions, the NCEMT enhances the DOD's weapons systems capabilities and empowers the defense industrial base with advanced, innovative, and affordable manufacturing processes.

Through these activities, the NCEMT continues to help the MANTECH Program maintain the readiness of U.S. warfighters through cost effectiveness, flexibility, availability, and optimum performance.

Sincerely,

A handwritten signature in cursive script, reading "Steven M. Linder".

Steven M. Linder
Director
Manufacturing Technology
(MANTECH)

state of the NCEMT

2 **T**he NCEMT is successfully helping the Navy improve reliability, optimize suppliers' processes and products, and reduce defects and repairs in metalworking.

4 **T**hrough integrated project teams, the NCEMT helps develop the best, most reliable, and most affordable solutions to metalworking problems in Navy weapons systems.

6 **B**y optimizing the use of commercial steels that meet military needs, the Navy reduces acquisition and life-cycle costs of surface ships.

8 **T**he NCEMT is working with the Navy and submarine builders to develop better fasteners, optimize casting and forging processes, and improve high-strength steels.

10 **A**pplying advanced aerospace materials and leading-edge technologies makes aircraft components more reliable and less expensive.

12 **T**he NCEMT is developing process parameters to improve production and performance of missiles and the prototype Advanced Amphibious Assault Vehicle.

14 **M**ilitary Interdepartmental Purchase Requests allow NCEMT-developed technologies to be adapted for other defense applications quickly with lower initial development costs.

16 **T**o transfer technologies effectively, the NCEMT sponsors and participates in workshops, demonstrations, and user groups, as well as maintains a comprehensive website containing engineering knowledge bases.



affordable metalworking solutions to defense problems



Comprehensive capabilities help the NCEMT in solving defense metalworking problems cost effectively.

The NCEMT focuses on process optimization. Traditionally, optimum process parameters were found iteratively through trial and error. Today, computer modeling and other prototyping methods are key to understanding processes, leading to reliable, affordable components.

Using state-of-the-art computer modeling in conjunction with demonstration factories, the NCEMT not only optimizes processes but also tests and verifies them, minimizing manufacturers' risks in adopting unproven technologies.

Computer modeling

Castings are a critical part of many weapons systems; computer simulation of the casting process helps foundry engineers to rapidly define optimum process parameters. The NCEMT continues its significant effort to

develop casting process simulation and optimization tools.

Forging is another traditional metalworking process that has seen significant improvements from computer modeling. Traditionally, forging advances occurred through innovative equipment design and an experience-based approach to developing processes on the shop floor. Today, the NCEMT uses computer modeling and simulation on advanced materials and new processes to produce low-cost, high-performance parts.

Computer modeling is also an effective tool for powder metallurgy (P/M) and semi-solid metalworking (SSM) processes. For this purpose, the NCEMT developed a finite difference simulation tool called ProModSSSM, which predicts common SSM process defects.

Demonstration facilities

An integral part of process optimization is adaption to full scale production. The NCEMT's demonstration factories provide the ideal facilities for carrying out this aspect of process implementation.

Demonstration facilities within the NCEMT provide

a cost-effective means of testing, evaluating, and refining metalworking processes, in addition to the effects of process changes on the quality, properties, and performance of a weapon system component. Furthermore, the full-size equipment in the demonstration factories are used for hands-on training.

The NCEMT operates state-of-the-art demonstration facilities in wire drawing, forging, sheet metal forming, welding, powder metals fabrication, and SSM. For example, the demonstration facility for P/M allows the NCEMT to generate P/M material property data for process optimization, and provide hands-on training in various processes. P/M enables near net-shape production and improved component performance as a cost-effective alternative to traditional manufacturing processes.



Photo: DOD photo by Petty Officer 2nd Class Felix Garza, U.S. Navy



Weapons systems components are manufactured, tested, and validated in the NCEMT demonstration facilities under conditions comparable to those of industrial settings. Over the years, utilization of the NCEMT demonstration facilities has significantly reduced costs and improved manufacturing technologies.

The NCEMT continually develops and enhances these capabilities as part of its commitment to improving quality and performance while reducing the cost of Navy weapons systems. ■

*ProModSS is a servicemark of
Concurrent Technologies Corporation.*



integrated project teams

The NCEMT recognizes the critical importance of working in teams to solve Navy problems.

Successful application of modern technologies involves several technical disciplines and requires input from everyone involved throughout the life cycle of a weapon system.

By forming integrated project teams (IPTs) that include industry, the Navy, and academia, the NCEMT ensures the development of cost-effective, advanced technology solutions to metalworking problems in Navy weapons systems.

Working in IPTs also increases the dissemination of enabling technologies to the industrial base and resolves

potential obstacles to implementing the results.

Enhancing processes

The NCEMT created an IPT to develop a low-cost method of producing structural castings with thin walls for turbine engines. Eliminating many of the current manufacturing steps could reduce costs by 30%. Rolls-Royce Allison, the engine manufacturer, is measuring the mechanical properties, redesigning the existing titanium fabrication into a nickel-based, single-piece casting, machine-finishing components, and testing components and engines. The production foundry, PCC Structurals, is evaluating the castability of candidate alloys and producing full-scale castings for finished parts. The NCEMT is enhancing existing computer models and applying them to the current casting practice to aid in designing an optimized process. The NCEMT is also transitioning technology to the industrial base, in part through users group meetings. The NAVAIR technical community provides oversight to ensure a cost-effective solution for the Navy. The resulting technology will be broad-based and, in the future, can be applied to a wide variety of turbine engines and missiles.

Another IPT was formed to enhance processing for high-strength steel castings and forgings for Naval components. The NCEMT is working with

Newport News Shipbuilding and the Naval Sea Systems Command (NAVSEA) to evaluate HSLA-130 steel as a replacement for AISI 4130 steel used in aircraft tie-down fittings. The IPT hopes to demonstrate that HSLA-130 can be welded (without preheat) to the HSLA-100 decks of aircraft carriers and exhibit wear resistance, corrosion resistance, and structural performance equivalent to 4130 steel.

Helping the British and U.S. Navies

The NCEMT has also formed an IPT to select materials and develop manufacturing processes to produce a low-cost, lightweight manifold for the joint U.S./U.K. Surface Ship Torpedo Defense (SSTD) Concept 1 Dispenser. This joint development will reduce the weight and manufacturing cost of the manifold, benefiting both British and U.S. Navies.

The weapons systems' primary designer, British Aerospace (BAe), is providing base product design data and validating the final product functionality. The NCEMT is evaluating potential materials and processes and conducting numerical process modeling studies to evaluate both material and product performance. Eight subcontractors in investment casting and plastic molding are participating in the product and process development. When the planned 2,880 systems are deployed, procurement costs could be reduced by \$46M.

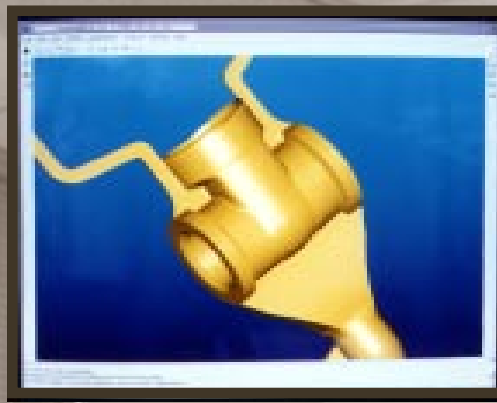




Making better ceramics for better transducers

The NCEMT also created an IPT to improve the mechanical reliability of ceramics used for Navy transducers. These transducers can be smaller, lighter, more reliable, and have a higher output than others. To improve manufacturing processes, commercial manufacturers are supplying materials and working with the NCEMT to identify sources of flaws and reduce their occurrence and size. Concurrently, the Naval Undersea Warfare Center–Newport will determine the impact of these changes on electro-mechanical properties. Successful process changes will be implemented immediately in the commercial manufacturers' facilities. Ultimately, the improved processes will benefit lightweight active sonars such as the Lightweight Broadband Variable Depth Sonar.

The NCEMT practice of working in IPTs ensures funds, resources, and expertise are utilized effectively—all of which contribute to the lowest possible cost of development and implementation of manufacturing solutions. ■



s h i p s

To meet current DOD requirements and reduce acquisition and life-cycle costs, the Navy is maximizing the use of commercial specification steels in surface ships. Current commercial steels, however, might not perform adequately in critical applications when subjected to military-unique loads.

To address this concern, the NCEMT is helping commercial steels meet Navy toughness and strength requirements.


Better steel production

The NCEMT is collaborating with the Navy, commercial shipyards, and domestic steel producers to optimize current steel production and fabrication procedures. By defining limits on plate manufacture, heat treatment, and fabrication, the NCEMT has shown that E-36 commercial steel meets Navy performance requirements. This enables the Navy to use the best steel for the best price. More than \$20M in acquisition costs can be avoided by using these commercial steels on the LPD 17-class Amphibious Transport Ships, the remaining DDG51 AEGIS Destroyers, and the future SC21 (DD21) and CVNX ship series.

Reducing fabrication and repair costs

The NCEMT is also working on two efforts to reduce naval ship fabrication and repair costs. One effort is on eliminating costly rework and possible in-service failures due to hydrogen-assisted cracking in high-strength steel castings. The other effort is on eliminating costly preheat of castings and forgings during welding. The NCEMT has determined that HSLA-130 steel can be forged and heat-treated to replace current aircraft tie-down fittings.

Photo: DOD by Petty Officer 2nd Class Jim Vidrine, U.S. Navy.



HSLA-130 has mechanical properties and weldability similar to the current material, and it is not susceptible to hydrogen-assisted cracking.

The NCEMT and Newport News Shipbuilding are evaluating the replacement tie-down fittings under field conditions by welding them to dimpled deck plates without preheating.

Better welding for better performance

The NCEMT is working with Naval Sea Systems Command to improve the performance of HSLA-65 welded joints in naval ship structures. Because of its reduced plate thickness, increased design stress levels, and improved weldability and weld quality, using HSLA-65 will reduce acquisition and life-cycle costs and improve performance. Estimates show HSLA-65 steel will save \$25M in life-cycle costs per ship for SC21 (DD21) surface combatants.

Before it is used on the hull of the CVNX2, HSLA-65 will be used for fabrication experience in certain applications on the CVN-77.

Based on designing entirely to yield level loading, at least 4,300 tons of weight

would be eliminated. Newport News Shipbuilding has estimated that \$10K is saved per ton of reduced weight; this totals \$43M in life-cycle cost savings for the CVNX2.

Producing acceptable castings

Another effort to reduce operational costs of Navy ships involves improving the centrifugal casting of TiC/bronze drums for hauling winches and anti-slack devices on underway replenishment ships. This effort is a collaboration with industry, and the Naval Surface Warfare Centers (NSWCs) at Carderock and Port Hueneme. The NSWC-Carderock developed the alloy that was tested at NSWC-Port Hueneme. From an NCEMT-developed process model, the principal processing parameters were established for acceptable castings. Functional tests on TiC/bronze drums show no measurable wear after 700 hours of simulated testing. Implementing this technology on underway replenishment ships will save an estimated \$25M annually. It can also be applied to torpedo shells, bearings, pistons, liners, and other sliding parts used by all services. ■



Photo: Lockheed Martin

Better ceramics

Transducers made of lead magnesium niobate (PMN) ceramics are smaller, lighter, more reliable, and have a higher output than those containing lead zirconate titanate. Current manufacturing techniques, however, produce PMN plates that are unreliable and have an unacceptably short life.

The NCEMT will test and conduct a failure analysis on materials supplied by commercial manufacturers and work with them to improve manufacturing processes. Concurrently, the Naval Undersea Warfare Center-Newport will test to confirm that improvements do not adversely affect electro-mechanical properties. All testing will then be repeated on materials manufactured with the improved processes, which ultimately will benefit lightweight active sonars such as the Lightweight Broadband Variable Depth Sonar.



Image: U.S. Navy image courtesy of Army Times Publishing Co.

submarines

To meet Navy needs for reliable and affordable submarines, high-strength steels are used for their combination of strength and toughness. Currently, however, these steels are costly to produce and difficult to weld.

Using undermatched weldments

Teaming with the Naval Surface Warfare Center–Carderock, the NCEMT successfully demonstrated the applicability of undermatched weldments on the New Attack Submarine (NSSN) pressure hull components. The work is now being expanded to use undermatched welds in non-pressure hull components. Shipbuilders will be able to use the NCEMT's computer models to decide on the proper implementation of undermatched welds in non-pressure hull components. These weldments will reduce the weight of the components and reduce the fabrication cost of the submarine.

Optimizing casting and forging processes

In conjunction with the Naval Sea Systems Command (NAVSEA), the NCEMT is eliminating several major problems with HY-80 and HY-100 castings for Navy submarines. These problems include hydrogen embrittlement, hydrogen-assisted cracking, and the need to preheat castings and forgings during welding.

To mitigate hydrogen embrittlement and hydrogen-assisted cracking, the NCEMT is determining the optimum thermal soaking treatment. To eliminate preheat during welding—saving an estimated \$1.65M annually—the NCEMT is investigating alternative casting and forging alloy compositions. Using these



alternatives will reduce costly rework and in-service failures.

Developing cost-reducing, advanced processes

Bethlehem Lukens Plate, the Navy, shipyards, and the NCEMT have teamed up to cost effectively produce heavy-gage steel plates. This effort will improve the through-thickness properties and weldability of the steel, which is used in critical ship and submarine structures for resistance to shock, blast, and ballistic loads. The NCEMT is optimizing the processing of heavy-gage steel plates to reduce porosity, segregation, and weld heat-affected-zone cracking, and to eliminate the need for preheat during welding.

In another effort, the NCEMT has completed shipyard testing to define operational envelope limits for advanced MIL-100S weld wire composition for HY and HSLA steels. This effort is being carried out in conjunction with the Navy Working Group on the Development of Advanced High-Strength Steel Filler Materials. The tests, under various extreme operating conditions, demonstrated that consumables are more resistant to hydrogen-assisted cracking and could, therefore, reduce or eliminate costly preheat and postheat requirements. Eliminating these requirements is expected to save \$13M per aircraft carrier and \$5M per submarine. In addition, the results can be applied to fabrication and repair of all Navy combat vessels.

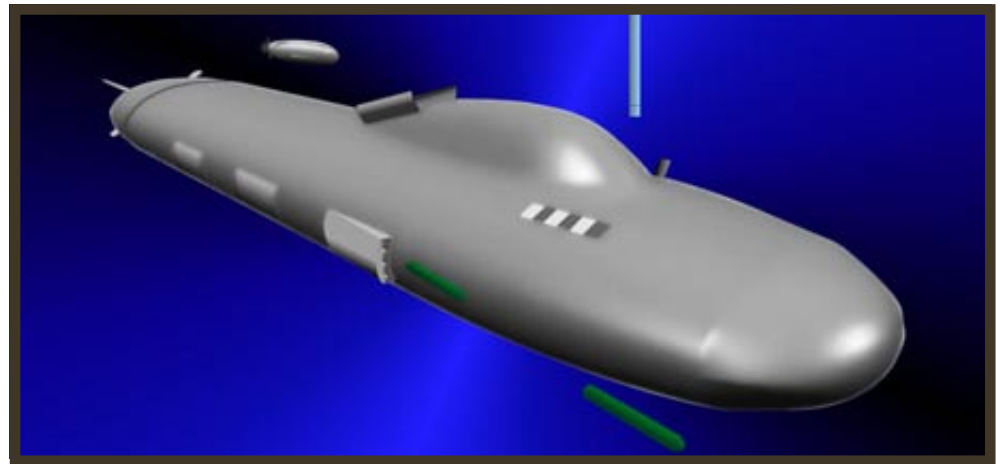
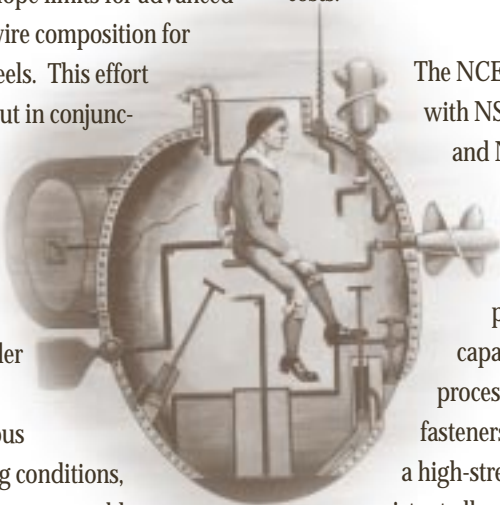
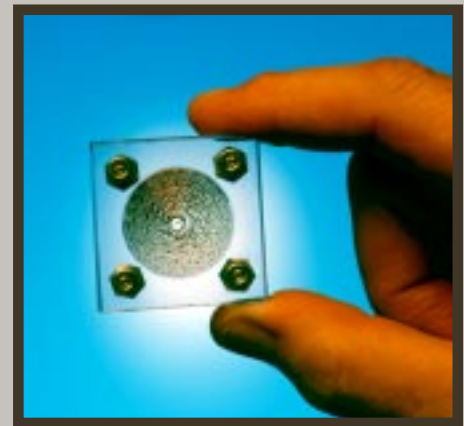


Image: General Dynamics Electric Boat

Using advanced materials

Another way to greatly reduce submarine life-cycle costs is with high-strength fasteners that are resistant to corrosion. Current fasteners require frequent inspections; replacing them with more reliable fasteners will reduce maintenance, procurement, and replacement costs.

The NCEMT, in cooperation with NSWC-Carderock and NAVSEA, will conduct tests to determine the reliability and performance capabilities of specially processed cobalt-based fasteners made of MP-159, a high-strength, corrosion-resistant alloy, for use in the harsh submarine environment. ■



NbTi superconductor

The NCEMT has investigated several technologies to clad high-purity aluminum onto superconductive core wire, including molten metal dip, spiral wrapping, and extrusion cladding. Additionally, an alternative conductor, using an artificial pinning technology, has been developed. Results of these technologies have been evaluated for both cost effectiveness and conductor performance. After comparing these results, extrusion cladding has been selected for full-scale process development. This technology is currently being scaled up from evaluation lengths of several hundred feet to production lengths of 30,000 feet, suitable for the Navy application.

aircraft

The NCEMT applies advanced materials and processes to ensure that aircraft components cost effectively meet the strictest standards of quality and reliability.

Improving reliability

The NCEMT is teaming with GE Aircraft Engines, PCC Airfoils, Westmoreland Mechanical Testing and Research, and the NAVAIR materials group to improve the reliability of turbine airfoils, critical components for Navy, Air Force, and Army jet engines. Unnecessary thermal cycles in manufacturing increase costs and lead to inconsistent mechanical properties at elevated temperatures.

After surveying thermal cycle variations in manufacturing, the NCEMT team has defined simplified thermal treatments for evaluation. The evaluation results will establish process, structure, and property relationships and optimize aging processes. The optimized processes will significantly improve jet engine reliability and save an estimated \$4.5M over the engine lifetime.

Developing robust aluminum castings

Aluminum fabrications are primary structural components of Navy/DOD aircraft, but they are expensive. Aluminum castings are less expensive but often have inconsistent properties. The NCEMT is developing robust casting technology with Boeing-St. Louis, Howmet Aluminum Casting, and Teledyne Cast Parts to consistently produce low-cost, high-quality aluminum castings for airframe structures. Several simple shapes have been cast to generate process, microstructure, and properties data. In addition, sub-component castings for the F/A-18E/F



Background photo of F/A-18: Boeing Company

fighter aircraft have been made. The technology should save \$12M for mission-critical F/A-18 E/F components such as the gun bay door.

Increasing engine reliability and reducing costs

The quality of the materials used in jet engine components critically determines their performance and reliability. For example, titanium alloys are used to manufacture critical engine rotating components. These alloys must be consistently free of inclusion and solidification defects. To ensure this, GE Aircraft Engines, Allvac, and the NCEMT are optimizing the plasma arc cold-hearth melting process, increasing the production rate by 50%. Hearth melting is superior to the conventional process for removing harmful inclusions. It also has great potential to improve the solidification structure and surface quality of as-cast ingots.

Thin-wall, superalloy structural castings can also increase the reliability, effectiveness, and affordability of aircraft engines. To produce large thin-wall components, the NCEMT is teaming with industry and the NAVAIR materials group to improve a mold withdrawal casting technique. This improvement will enable the fabrication of low-cost, single-

piece, thin-walled, nickel-based alloy castings, which will save an estimated \$24M in acquisition costs for the T406 engine.

With Rolls-Royce Allison, Ladish, and Special Metals, the NCEMT is reducing costs of the T406 engine by enhancing powder metallurgy (P/M) processing. To improve turbine disk quality, selective sonic inspection has been combined with hot isostatic pressing, extrusion, and isothermal forging of ultrafine metal powders. This combination also reduces the production cost. For example, applying these improvements to disk stages 1, 2, 3, and 4 of the T406 engine could reduce the acquisition and maintenance costs of the V-22 Osprey by \$38M over the life of the program. ■



Image: Boeing Company

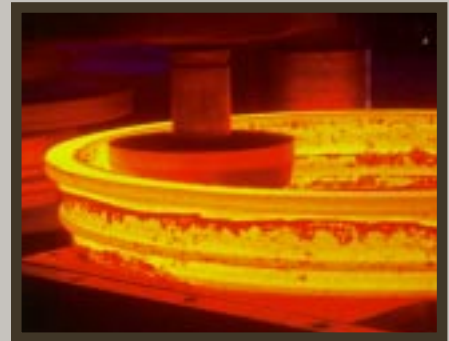


Photo: Firth Rixson Viking

Forging Supplier Initiative support

The NCEMT supports the Air Force/Navy Forging Supplier Initiative program in its goal to make forged components of the Joint Strike Fighter (JSF) more affordable.

Forged components make up almost 32% of the cost of aerospace propulsion and structural systems; this initiative aims to lower the acquisition costs of aerospace forgings by 35–40%. The NCEMT will evaluate current modeling tools and technologies, including simulation packages, in order to optimize forging processes.

This initiative could reduce the cost of the forged components for just the JSF by \$1,600M. This represents a rough order of magnitude return on investment to the DOD of more than 130, based on the Navy investment of \$3.1M and the Air Force investment of \$9M.

missiles/ordnance



Conventional manufacturing of missiles, ordnance components and their platforms has become costly due to tightening environmental regulations and performance requirements. Advanced manufacturing processes, however, satisfy these regulations while lowering costs and improving performance.

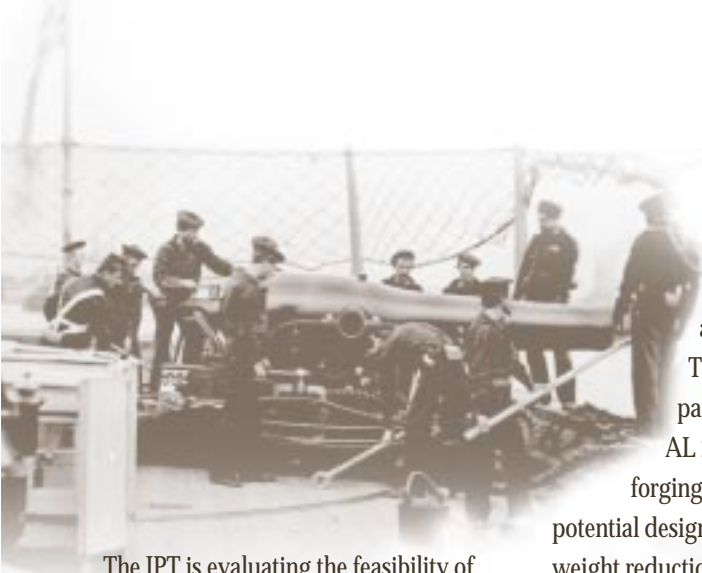
Optimizing processes for 5-inch gun casings

The NCEMT is working with the Naval Surface Warfare Center-Indian Head to produce an affordable cartridge casing for the 5-inch gun systems. The flow-forming process is being evaluated to take advantage of its flexibility and lower tooling costs, compared to the deep-drawing process traditionally used. With little change in tooling, cartridge casings of various sizes and calibers can be manufactured. The NCEMT is working on process and product optimization to ensure the required tolerances for optimum ballistic performance can be met cost effectively. Successful implementation is expected to save the Navy \$2M per year.

Improving gun barrels

Conventional hard chrome plating methods of protecting gun barrels from wear and erosion have become cost-prohibitive due to environmental compliance costs. In response, the ARDEC Cannon Wear and Erosion integrated project team (IPT) is working to improve the performance and extend the life of gun barrels. As a member of this IPT, the NCEMT assessed the current coating and surface treatments to find alternatives. As a result, electrospark deposition, cathodic arc deposition, and chemical electrodeposition methods have been selected for further evaluation.

*Photo Inset of 5-inch gun shell:
DOD photo by Petty Officer
2nd Class Felix Garza, U.S. Navy*



The IPT is evaluating the feasibility of applying these processes to coat inside diameters as small as 25 mm (1 inch). Coatings that perform well in vented combustor testing will be evaluated in simulated firing trials in short barrel segments before being applied to a full-size barrel for service testing. The most suitable technique will be implemented to upgrade small- and medium-caliber weapons for the Navy and the DOD.

Meeting future AAV requirements

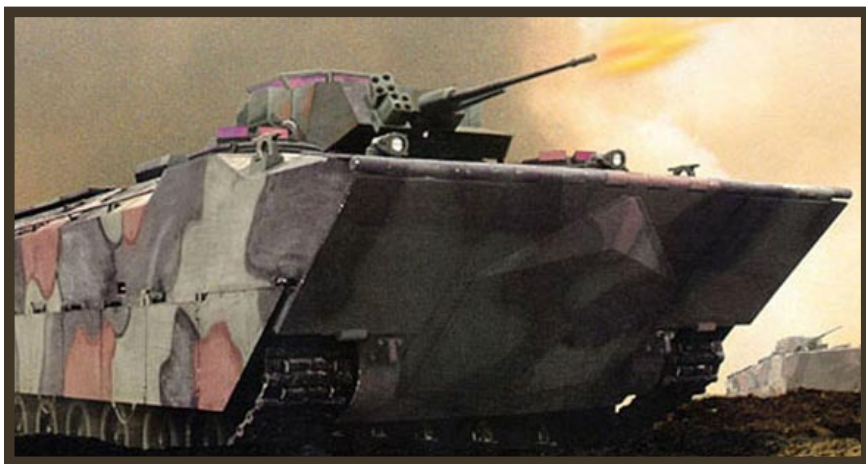
The combined mission demands for the Advanced Amphibious Assault Vehicle (AAV) require high degrees of survivability, mobility, lethality, and reliability while minimizing weight. High-strength, lightweight aluminum alloy AL 2519 is key to meeting these requirements.

Using AL 2519 armor plates in the construction of the AAV requires the

development of appropriate manufacturing technologies and comprehensive performance data for AL 2519.

The NCEMT is developing parameters for producing AL 2519 extrusions and forgings, which may facilitate potential design revisions for further weight reductions. In addition, friction stir welding is being evaluated to enable the use of butt welds for joining plates, thus simplifying the AAV design. A corrosion working group has been formed to identify advanced corrosion protection techniques to guard against both general corrosion and stress corrosion cracking.

AL 2519 will enable the use of thinner plates while providing excellent ballistic protection, thus reducing costs significantly through weight reduction. The reduced weight, improved manufacturing technology, and extended life cycle are expected to save \$16M to \$22M in the production and fielding of the planned 1,000 vehicles. ■



NCEMT website (www.ncemt.ctc.com)

The NCEMT website offers information about past and current projects, upcoming events, publications, technical presentations, and technology demonstrations. The website also offers several engineering knowledge bases, including:

Atlas of Formability provides flow stress, microstructural response, and workability information for more than 100 engineering materials.

Aluminum Stabilized NbTi Superconductor provides information on developing aluminum cladding and conductor-forming processes to achieve the desired superconducting properties and reduce manufacturing costs.

Powder Metallurgy Materials consists of mechanical and physical properties for 128 powder metallurgy alloys, drawn from 10 alloy systems with variations in composition, carbon content, density, and heat treatment.

Thermophysical Properties offers reliable thermophysical properties information and data for modeling, controlling, and optimizing the metalworking processes used in the production of Navy components.

leveraging

Many of the technologies the NCEMT develops for the Navy MANTECH program can be adapted for wider application within the U.S. defense industrial base. This leveraging, through a Military Interdepartmental Purchase Request (MIPR), enables proven technologies to be adopted quickly with fewer obstacles to implementation and lower initial development costs.

Developing mine counter measures system

The Naval Air Systems Command and the Program Office for Mine Warfare Airborne Mine Defense asked the NCEMT to independently develop a prototype carriage, stream, tow, and recovery system (CSTRS) for Organic Airborne Mine Counter Measure (OAMCM) systems.

Currently, the AN/AQS-20 sonar is carried inside and deployed through the

rear door of a large, aging, expensive-to-operate MH-53 helicopter. The Navy will replace this helicopter with the much smaller and lighter CH-60S helicopter for multi-mission use. The AN/AQS-20 sonar and other OAMCM systems will then be carried outboard and deployed from the side door of the CH-60S helicopter. The CH-60S helicopter calls for a lighter, smaller CSTRS that maximizes mission time with little effect on the aircraft performance.

The Navy needs to deploy five different OAMCM systems from this helicopter, using a common CSTRS. To meet this need, a Navy team recommended a palletized CSTRS for the CH-60S. This palletized system will utilize the winch that is internal to the aircraft and support the OAMCM devices on a specially designed structure attached to the pallet and extending outside the aircraft. The CSTRS carries, streams, and recovers the devices from the water. Rather than being carried through the CSTRS, the OAMCM load is transferred directly to a tow cable attached to the helicopter at its centerline.

The CSTRS must be designed to integrate and meet the divergent requirements of the helicopter manufacturer, total systems integrator, winch



Photo: Transportable PEPS unit

developer, CSTRS developer, and the developer of each OAMCM system.

Handling hazardous waste streams

DOD activities produce a variety of problematic waste streams that must be safely and effectively disposed. To address this issue, the Army Construction Engineering Research Laboratories (CERL) tasked the NCEMT to help develop a prototype mobile Plasma Energy Pyrolysis System (PEPS) for treating the resulting waste streams. The mobile PEPS will be a scaled-down version of the transportable PEPS unit. The NCEMT has teamed with CERL and Vanguard Research, Inc., which has the rights to the PEPS technology, to develop and demonstrate the mobile system.

Traditional hazardous waste treatment processes, such as incineration, require

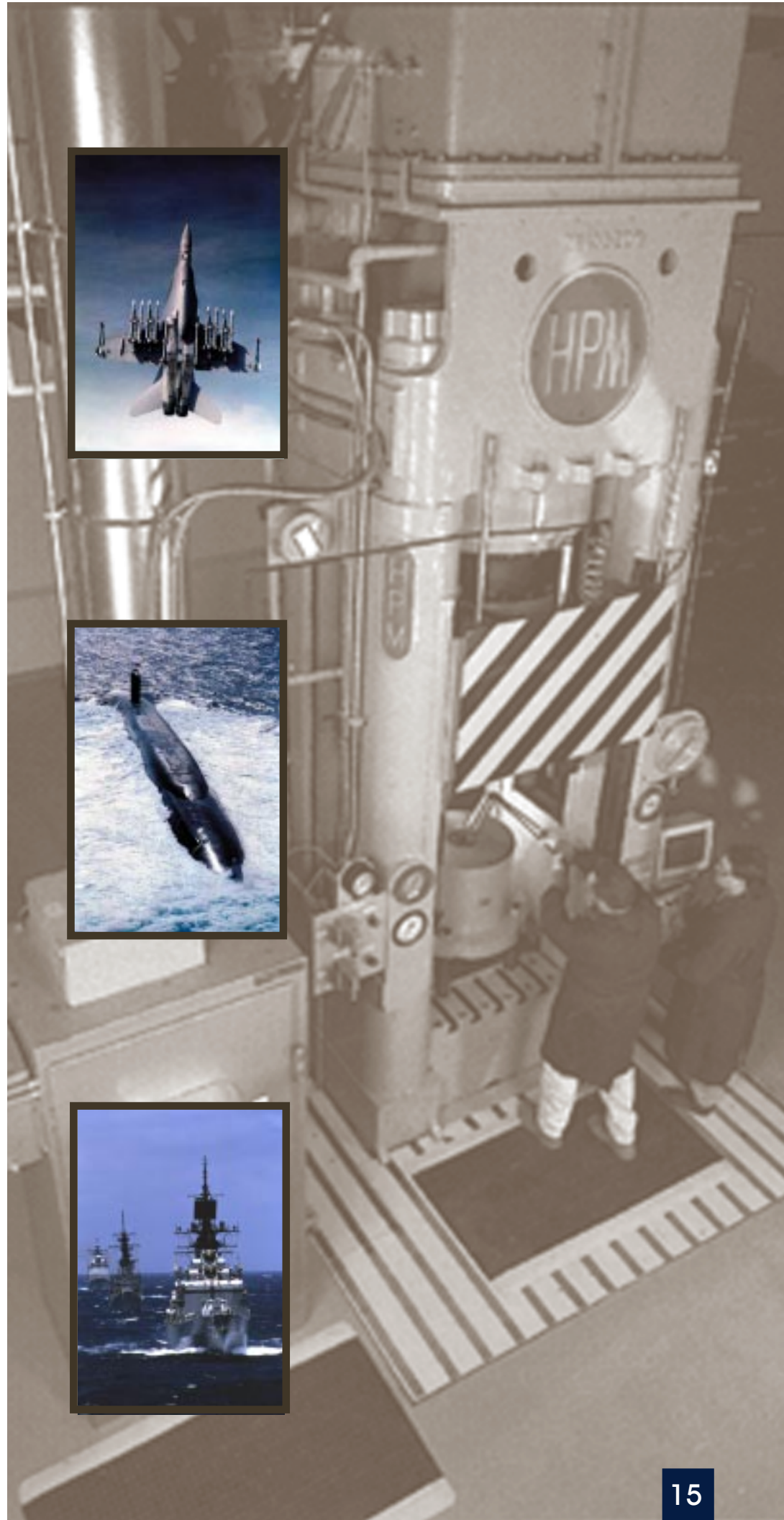


multiple process steps. The state-of-the-art PEPS technology can, however, destroy hazardous materials using a single-step pyrolysis and vitrification process. Furthermore, operating in a reduced oxygen atmosphere at temperatures in excess of 3,000°F, the PEPS unit creates a product gas stream with considerably less volume than that generated by traditional combustion systems. Thus, the PEPS system requires a smaller equipment footprint, a smaller air pollution control system, reduced system costs, and lower energy consumption.

The project team will design, procure, assemble, install, and demonstrate a mobile PEPS unit for ground transport to various military sites. It will be tested for reliability, maintainability, mobility, and its ability to meet environmental requirements.

The NCEMT will ensure that all performance and environmental requirements are met or exceeded. The goal is to treat problem wastes for less than \$500 per ton of waste, which will make this technology competitive with current waste treatment processes such as landfilling and incineration. This technology has equal potential for treating wastes from the Navy, Army, and Air Force, as well as other government or industrial organizations.

The NCEMT is providing technical and project oversight during the design, build, and test phases, and is identifying DOD sites with suitable waste streams that are willing to participate in the testing. ■



technology transfer

The NCEMT engages in a variety of time-honored, cutting-edge technology transfer activities to facilitate the use of advanced technologies by the civil-military industrial base.

These activities include workshops, training courses, users groups, information exchanges, and technology demonstrations. They give members of the Navy, government, and commercial industry a hands-on opportunity to learn

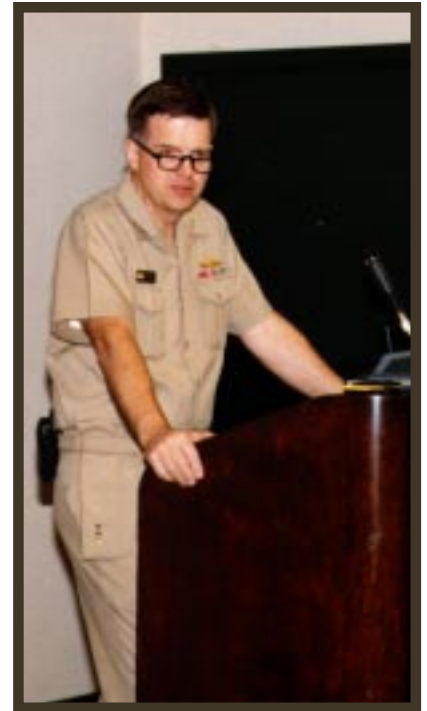
state-of-the-art techniques and processes. To ensure technical developments get maximum visibility, the NCEMT participates in numerous conferences, publishes in various metalworking journals, issues technical reports, and maintains a comprehensive website with several electronic databases.

The following are highlights of 1999 technology transfer events.

Aerospace Materials Workshop

In April, the NCEMT held the Manufacturing Technology for Aerospace Materials: A Technology Demonstration and Information Exchange in Arlington, Virginia. The workshop brought together managers and technical personnel of government agencies and weapons systems program offices, as well as manufacturers and suppliers of aerospace systems, materials, and components. The program highlighted and demonstrated the successful development and implementation of special melting, casting, and forming techniques, as well as other emerging technologies. The use of these technologies to meet current and future technology needs of the Navy/DOD Program Offices was also discussed.

In conjunction with this event, two users group meetings were held: Structural Aluminum Casting Technology and Thin Wall Superalloy Structural Casting. Regularly scheduled meetings of these



Vice Adm. George P. Nanos, Commander, NAVSEA, speaking at the Modern Shipbuilding Technologies Demonstration and Information Exchange.

users groups offer the opportunity to disseminate the findings of NCEMT work and to solicit other ideas for applying the technologies.

Modern Shipbuilding Technologies Workshop

In September, the NCEMT presented the Modern Shipbuilding Technologies Demonstration and Information Exchange in Arlington, Virginia. The NCEMT presented innovative technologies, materials, and tools for reducing acquisition and life-cycle costs for Navy and commercial ships. Current and future technology needs of the Navy/



Industrial Technology Training and Educational Services (ITTES)

Through the Industrial Technology Training and Educational Services (ITTES) initiative, the NCEMT provides training in metalworking technologies to the Navy program offices and technical communities. The NCEMT uses state-of-the-art training resources, such as distance learning, CD-ROMs, and Web-based courses, to maximize the learning experience.

DOD Program Offices were discussed, and opportunities were identified for jointly implementing new technologies. The event featured Vice Adm. George P. Nanos, Commander, NAVSEA, as keynote speaker.

The users group for the Optimized Commercial Steels for Naval Surface Ships project took advantage of this gathering to meet and disseminate the findings of their work and to solicit other ideas for applying the technologies.

NCEMT website

Industry, government, and academic technologists continue to access the NCEMT Internet Information Server (www.ncemt.ctc.com) to obtain valuable data and information that are critical to their work on Navy/DOD weapons systems components. This website includes key engineering knowledge bases such as the Atlas of Formability, Powder Metallurgy Materials, Porous Materials, and Thermophysical Properties. More than 1,000 technologists are registered users of these valuable resources. ■





National Center for Excellence in
Metalworking Technology

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For more information, contact:

NCEMT Information Services
Concurrent Technologies Corporation
100 CTC Drive
Johnstown, PA 15904
Phone: (814) 269-2809
Fax: (814) 269-6480
E-mail: slippy@ctc.com

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Inset photo of Y22: Lockheed Martin*